MECKEL'S DIVERTICULUM.[1]

WITH REPORT OF STRANGULATED INGUINAL HERNIA OF SAME.

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MECKEL'S diverticulum, or the diverticulum ilei, is sufficiently common to merit a greater familiarity with it than commonly exists, and its importance arises chiefly from its relation to certain forms of intestinal strangulation, to the persistence from birth of a fæcal fistula at the umbilicus, and, more rarely still, to its presence in a hernia. It is my desire to place on record a case of strangulated inguinal hernia in which the sole contents was a Meckel's diverticulum. It may be of interest in this connection to give a general outline of this diverticulum, its origin, development, and subsequent changes.

Lavater is said to have been the first to record its having been observed, and Ruysh, in his "Thesaurus Anatomicus," published in 1701, also called attention to this abnormal development, giving it the name of diverticulum and presenting an illustration of the same. Morgagni, in his treatise on the "Seats and Causes of Disease," reports several cases of diverticulum of the ileum, and also mentions that he had a case of inguinal hernia in which it was found, and states, also, that he had seen the same diverticulum in geese, particularly one of such breadth that it could not be taken for the remains of that duct which has formerly belonged to the vitellum, thus recognizing its embryologic import and derivation.

We must, however, render to Johan Friederich Meckel the distinction of first calling a more general attention to the diverticulum ilei, which in his essay he most clearly differentiated from the acquired pseudodiverticuli occasionally found along the course of the intestinal canal. It was Meckel who advanced the theory that it represented the remains of the omphalomesenteric duct, which theory has received common recognition. He also called attention to its importance in the causation of certain intra-abdominal affections.

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It is interesting to note that the American ornithologist, Elliot Coues, to whom the research of Meckel seems not to have been known, reports two cases of these rare formations under the name of umbilical cæca. His deductions are most interesting, as he not only arrives at the same conclusions drawn by Meckel fifty years previous, but from his knowledge of ornithology the more fully substantiates this theory. Coues states that in the Class Aves a true umbilical cæcum is frequently to be met with, forming a diverticulum or pouch, to which those described by him are at least in their material features quite similar. This diverticulum he states is situated at the original point of entrance of the vitelline duct into the intestine, and is the remains of, or rather an indication of, the previous existence of the duct. He further adduces the confirmatory fact that a remnant of an embryonic organ is quite persistent and very generally to be found throughout the lower orders of birds, as the Grallatores and Natatores, while in the higher orders, as in the Raptores and Passeres, it is only of exceptional occurrence and difficult of recognition.

Ahlfield, among others, denies that the diverticulum derives its origin from the vitello-intestinal duct, and claims that it is developed as the result of traction upon the intestines by the ductus-omphalo-mesentericus. This duct normally remains in connection with the intestine until the latter recedes into the abdominal cavity, or at about the third month. At this time discontinuity between the duct and intestine should occur. Should this disconnection not occur, manifold congenital variations of the gut may result. Among these variations is mentioned Meckel's diverticulum, it being the direct result of traction exerted upon the intestinal wall, which, gradually giving way at the point of greatest traction, gives rise to the formation of such an appendage.

The relative frequency of the occurrence of this diverticulum was noted by Rolleston, of St. George's Hospital, to be ten in 337 cases examined, a percentage of 3.37 per cent. Osler observed it in 2 per cent. of cases. In the Collective Investigation of the Anatomical Society of Great Britain and Ireland, it was found sixteen times among 769 subjects, a trifle over 2 per cent. This is in accordance with the statements of Quain and Treves. Mitchell found it present in thirty-nine cases out of 1635 examined, or slightly over 2 per cent.; but remarks that its order of occurrence is quite inconstant; thus in 200 successive autopsies not one case was found, and then again its presence was noted in two successive cases. Kelynack found but eighteen examples among 1446 subjects examined, a proportion of a little over 1 per cent., while Albers says that it occurs about one time in 1000 subjects examined, making it $^1/_{10}$ per cent. This certainly seems too low an average. Out of Mitchell's thirty-nine cases, it was found four times in women and thirty-five in men. Kelynack in eighteen cases reports eleven as occurring in males to seven in females; there being thus a decided preponderance in frequency in the male. While the frequency of its occurrence has varied considerably according to the various observers, yet it will be found that its location is subject to still greater variance. Meckel's diverticulum is usually stated to be in the lower fourth of the ileum, at a variable distance of from one to four feet from the ileocolic valve, this being the position assigned to it by Meckel himself. Gegenbauer gives it at from one-half to two metres; Henle as one and one-half to three feet; Quain as an average of forty-eight inches, with a variation of from eleven to 120 inches. Tillman states it to be one-third to one and one-third metres from this point; Hemmeter says one to six feet, averaging two and one-half to three feet; Treves from fifteen to thirty-six inches; Kelynack gives an average of thirty-nine and one-half inches in eighteen cases examined with the extremes of fifteen to fifty and one-half inches; Lamb, in a tabulation of 185 cases, reports it being situated in 21 per cent. between the ileocolic valve and one foot above this valve; in 19 per cent., two feet above the point; and in 12 per cent., two to three feet distant.

It does not seem, however, that the diverticulum is restricted to any particular portion of the intestinal tract, for it has been described as located anywhere from the pylorus to the ileocolic valve, and to have been found in the cæcal region as well as upon the œsophagus. The term diverticulum ilei is, therefore, misapplied, as it occurs in the jejunum in a considerable number of cases. Lamb found the record of fourteen cases in which it had occurred in the jejunum and of seven where it had been found in the duodenum. Buzzi reports a case where a diverticulum thirty-three millimetres in length was found on the jejunum opposite its mesenteric border and one metre distant from the duodenojejunal angle. From its anatomical character and the microscopical research, he concluded that it was to be regarded as a misplaced Meckel's diverticulum. Treves, however, cites this case as being a congenital diverticulum of the jejunum quite distinct in origin from Meckel's diverticulum. Similar cases are also reported by Clarkson and Collard, in one of which it was said to have its origin two feet from the pylorus. Dr. Elliot Coues reports two instances of this abnormal point of origin. Meckel refers to four cases reported by Walther and one by Grieding, in all of which the jejunum was the site of this vestigial structure, and considered them to be identical with those having their connection with the ileum.

Lamb states that it has been found seven times in connection with the duodenum, and refers to two cases in the Army Medical Museum. In one of these, a female mulatto seventy-one years old, it was found to arise from the middle of the duodenum, being about two inches long, and having its outer wall so thinned that the presence of the muscular wall seemed to be problematic. Albers also reports a case of this kind in which the diverticulum arose from the transverse portion of the duodenum. Mayers reported a case arising from the duodenum, and containing a number of valvulæ conniventes for a short distance from its point of origin. Nor, as has been before suggested, has the remaining portion of the alimentary tract been exempt from its occurrence. Fitz, in a paper on " Persistent Omphalomesenteric Remains," refers to the well-authenticated case of duplication of the œsophagus, small intestine, cæcum and colon, and explains such anomalies on the assumption of an abnormally high or low seat of the omphalomesenteric duct. A duplication of this kind being of diverticular origin has originally a blind extremity; through the accumulation of meconium or pressure, perforation may result, and thus explain the communication with the intestine proper which usually exists at both ends. Fitz concludes his statement by saying that the view that most, if not all, well-authenticated instances of duplication of its course are the probable result of persistence, and growth of the remains of the vitelline duct is rendered highly probable from what is known concerning the development of the intestine.

The abdominal cavities are not differentiated at that period in fœtal life when the vitelline duct is present. The seat of the latter, high up or low down in the fœtus, would satisfactorily account for the various places of origin of the duplication in question, as it does for those of the diverticulum. It has already been made apparent that the latter may arise at any point between the pylorus and the cæcum. Whether the duplication or the diverticulum is to result, depends presumably on the existence of conditions favoring or checking the growth of the intestinal walls. The duplication is thus to be regarded merely as an elongated diverticulum, and, like the latter, as will be shown later, may lie within as well as outside the mesentery.

This variability of position can alone be explained along developmental lines. In its earlier state the intestinal tube or gut tract is differentiated into three portions: a head-gut which lies cephalad to the intestinal attachment of the vitelline duct, a hind-gut which lies near the tail end of the embryo, and the mid-gut or intervening third portion. Later, *i.e.*, during the fifth and sixth weeks, when the pharynx, œsophagus, stomach, and part of the duodenum have become differentiated in the foregut, the mid-gut becomes U-shaped, and is then known as the umbilical flexure or navel loop. From this portion of the intestine are now developed the lower part of the duodenum, cæcum, and colon. At the point of greatest convexity of this flexure the vitello-intestinal duct is attached, and towards it, also, proceed the omphalomesenteric arteries. From the upper limb of the umbilical flexure is subsequently developed the jejunum and part of the ileum; from the lower limb, the remainder of the ileum, cæcum, and ascending colon. Since the point of attachment of the vitelline duct, as Heisler says, is not far from the termination of the small intestine, Meckel's diverticulum, when present, is connected with the lower part of the ileum at a point from one to three feet from its termination. In the subsequent development of the small intestine, however, different portions may be hindered in its growth, as Leichtenberg states, the greater part of the small intestine is formed from the posterior or lower leg. The diverticulum in such a case would then be placed abnormally, *i.e.*, in the jejunum or even duodenum. A retardation of growth in the lower limb would, on the other hand, explain those cases in which Meckel's diverticulum is found a short distance from the ileocolic valve. This is the view which has also been advanced by Fitz, who, relative to the variation in the position of Meckel's diverticulum, says, " Since the diverticulum is present, if at all, in the earliest weeks of fœtal life, it is obvious that its position with reference to the ileocæcal valve must change with the growth of the intestine. The preponderant elongation of the intestinal tube above the insertion of the duct is accompanied by a less longitudinal growth below this point, and the diverticulum is usually found in the vicinity of the valve." The occurrence of the diverticulum prolongation on the ileum, jejunum, and lower duodenum is most rationally explained by this theory. In the upper portion of the duodenum in its first and second parts diverticuli may, however, be of different origin. It is known that the hepatic diverticulum, from which the liver is developed, may give rise through developmental defects and aberrations to certain of these congenital duodenal diverticuli. Such diverticuli also occur as isolated pouches, which, when present, are constant in position, *i.e.*, above the biliary papilla, according to Treves. Other objections to the assumption that the duodenal diverticuli are in their origin vitello-intestinal are also apparent in the cases reported.

In the case of Lamb, the absence of muscular fibres rather denotes an acquired character, and it can, therefore, not be considered a congenital structure. It belongs to the cases of false or pseudodiverticuli, to which attention had been called by Rokitansky.

As to the remaining parts of the alimentary canal (œsophagus and cæcum) in which the occurrence of duplication has been referred to, the abnormal position of the diverticulum and its subsequent growth, as already alluded to in the view of Fitz, are dependent on the primary connection of the vitello-intestinal duct and intestine, and does not result from a disproportion in growth of the digestive tract. The exact position of the diverticulum on the intestinal loop is in the great majority of cases along the free border of the gut or opposite to its mesenteric attachment. Yet this, too, is subject to variation. Kelynack observed that its origin was not always immediately opposite the mesenteric attachment. Kern in a case of patulous umbilicus, which he operated on, found that the Diverticulum Meckelli arose from a position which was not directly opposite the mesenteric attachment of the intestine, but which lay towards the lateral aspect of the gut; and Dennis, in his " System of Surgery," figures several specimens in which the diverticulum springs from the mesenteric border, and lies intramesenteric. In two cases reported by Mitchell (Cases 5 and 13) it arose from the side of the gut, in one of these close to the mesentery. Fitz, in speaking of this lateral variation, remarks that the instances are not few in which the side of the intestine, even the immediate vicinity of the mesenteric attachment, is the starting-point. He then refers to a case in the Warren Museum, Specimen 732, an intramesenteric duplication of the intestine, which was found in a child from eight to ten months old. Two intestinal tubes more or less parallel are to be seen in this specimen, one being in the usual position of the intestine, the other to its inner side, between the two layers of the mesentery.

The diameter of the inner tube is somewhat smaller than that of the outer, except in the immediate vicinity of the opening, at which the two tubes communicate where a dilatation exists. The contiguous portions of these two structures are in close proximity to each other throughout the greater part of their course and are fused near the common opening. This opening is rounded, sharply defined, one-third of an inch in diameter, and appears to be covered with mucous membrane. The walls of these tubes are composed of mucous, muscular, and peritoneal coats; the mucosa of the outer tube showing slightly projecting transverse folds in the vicinity of the opening, while that of the inner tube is relatively smooth. Villi and crypts are said to be present in both these structures. Fitz concludes that in these cases the most satisfactory explanation of the origin of this anomaly is based upon its representing an intramesenteric diverticulum, although its bifurcated shape and seat of constriction and dilatation deserve special consideration. As both these characteristics may, however, be possessed by other diverticuli, this objection is not valid. Dennis reports a similar case of intestinal duplication where the accessory gut lay intramesenteric, and for the explanation of which the omphalomesenteric theory is advanced. The cases of intramesenteric cysts of Roth are also to be classed under this category of lateral variation of Meckel's diverticulum, as stated by that writer himself. Treves, however, remarks of these cases that it is a question whether the elongated diverticuli, which are described as growing between the layers of the mesentery, are real instances of Meckel's diverticulum, but gives no evidence as proof of this assertion.

The length of Meckel's diverticulum is in part dependent on the degree of involution the omphalomesenteric duct undergoes. Normally, the involution of this embryologic structure is complete, and no trace of its former existence is to be found in man. When present, however, its length forms one of its most inconstant characteristics. It is found as a small, blunt, peglike projection, and varying up to a diverticulum ten inches in length. Its average length as given by Quain is one to three inches; by Rokitansky, five to six inches; by Henle, one-half to six inches; by Albers, one to seven inches; by Kelynack, one-half to six inches, or an average of two and one-quarter inches. Cazin gives it as one to seven inches, or eight inches; and Treves as two to three inches. Lamb, in a tabulation of 185 cases, found its length definitely given in 109 cases. In forty-four cases it was reported as being from one to two inches long; in twenty-nine, from two to three inches; in fifteen, from three to four inches; in five, from four to five inches; in two, six inches; and in one, seven inches. Lamb concludes that of the entire 109 cases, the number of those in which the diverticulum was between one to two inches long exactly equalled those in which it was between two to four inches, giving an average, therefore, of two inches in length.

The usual form encountered is the tubular variety resembling the finger of a glove. In such a cylindrical prolongation the diameter nearly equals that of the gut proper. In many instances the diverticulum when of this form tapers more or less gradually towards its blind extremity. According to Treves, the diameter of its base is usually less than that of the gut from which it arises, although sometimes the diameter of the two tubes may be nearly identical. It may also retain the same width throughout, and thus resemble a glove-finger; but its base is usually considerably wider than its free extremity. Tillman states that the diverticulum has sometimes a greater diameter than the small intestine itself. When attached to and patulent at the navel, the diameter throughout its course may remain unaltered, or be but slightly diminished at its umbilical attachment. Among the divergencies from this usual form are to be mentioned the presence of constrictions which may occur throughout its course, most usually, however, towards one of its two extremities. At the junction of the small intestine such a constriction, when marked, gives rise to the globular or inversely conical variety, in which the diverticulum was connected with the ileum by a narrow mouth three-quarters of an inch wide, then extended to a diameter of one inch and rapidly widened into a large pouch almost as big as the cæcum. This dilated portion had a diameter of three and one-quarter inches, a circumference of ten and one-half inches, and lay quite free in the abdomen. Kelynack suggests that its large size is probably of an acquired nature, and that it may be referred to as a distention from the intestinal contents. When the constriction becomes complete in the globular variety, the communication with the small intestine may entirely, or almost altogether, cease, and the diverticulum, as Roth has shown in the report of several cases, give rise to an intra-abdominal cyst.

The extremity of the diverticulum varies considerably in shape. Thus it may be clubbed-shaped or, in rare cases, it may be bifid. Both Kelynack and Fitz refer to such cases. Treves speaks of a specimen in the London Hospital Museum in which the ampulla at the end of the diverticulum had a hammer-shaped outline. Hyrtl remarks that branch-like diverticuli are very rare, but reports an instance in which a diverticulum one inch in length and divided into five parts was found in a hemicephalic monster. More important than any of these cases are those in which the extremity is patulous and communicates with the exterior at the umbilicus. A patulous Meckel's diverticulum at the umbilicus gives rise to a fistula or what has been termed anus præternaturalis umbilicalis. This patulency is generally ascribed to the free end of the diverticulum extending through the umbilical ring into the umbilical cord, so that when the cord is severed the extremity of the intestinal appendages is likewise exsected. With the subsequent exfoliation of the navel the umbilical fistula is established. This view is advanced by Merian von Seibold and Shepard. Bart, on the other hand, claims that this does not occur, and the existence of a congenital umbilical hernia is not essential for the patulency of the umbilicus to result. According to this writer, the extremity of the diverticulum merely extends to the umbilical ring, and does not pass beyond the same. A necrosis which may follow the separation of the cord can, however, establish an intestinal umbilical fistula.

In its structure, Meckel's diverticulum resembles the small intestine, being composed of three coats. In the muscular coat both the longitudinal and circular fibres are directly continuous with those of the small intestine. The mucosa is like that of the intestine, containing Lieberkuhn's crypts, solitary follicles, and Peyer's patches. Of the latter but one is commonly found, and when present is subject to the same pathologic changes as take place in the ileum. Vaughn reports a case in which at the autopsy of a patient, who died of enteric fever, a diverticulum was found seven and one-half inches in length, and containing two small swollen Peyer's patches near its origin and several enlarged ulcerating, solitary glands. At the junction of the diverticulum and ileum the mucosa in reduplicating may give rise to a valve. Meckel observed its presence in three cases out of over twenty examined. He interpreted its presence to be an attempt at closure. According to Buzzi, Klebs also mentioned its occurrence, as did Cazin and Albers, who referred to a valve-like formation similar to those found at the ileocæcal and appendiculocæcal junctions. Roth reports a case in which this valve almost completely closed the intestinal opening, and thus accounted for the small amount of intestinal contents which escaped through its fistulous opening at the umbilicus, the tube being large and patulous in its other parts. Structurally, this valve consists of a reduplication of the mucous membrane, between the two layers of which a certain amount of connective tissue is found; towards its attached end a few muscular fibres are also present. Roth says that a similar though much less distinct valve may occur at the umbilical end of a patulous diverticulum, ordinarily from the obliteration of the emphalomesenteric vessels, but may, according to Treves, be referred in some cases to the obliteration of a part of the diverticular extremity.

The occurrence of Meckel's diverticulum in a hernial sac has been frequently referred to by various writers and observers. Morgagni and Littre each report a case of this kind in a scrotal hernia. Meckel himself, and since his report many writers have mentioned and alluded to the possibility of its occurrence. Cazin, in the dissection of the scrotal hernia, describes a diverticulum found in the sac. Duplay and Reclus, also Ludwig and Tilling, have published in their surgical works and papers instances of umbilical hernia containing Meckel's diverticulum.

The hernias in which the diverticulum has so far been exclusively found are those of the umbilical and inguinal variety, and especially in the congenital type of the umbilical, or in the funicular hernia; there is a predisposing factor for the retention of Meckel's diverticulum in the hernial sac. According to Ahlfeld, the congenital umbilical hernia is caused by an abnormal thickness of the vitello-intestinal duct, which prevents the recession of the intestine into the abdomen, thereby giving rise to the formation of a hernia. The portion of the intestine attached to this duct is in all cases the last to enter the abdominal cavity, and therefore, when Meckel's diverticulum is present, and such a hernia exists, it is to be found among the contents of the intestinal protrusion.

To this class of congenital umbilical hernia belong the many instances of Meckel's diverticulum patulous at the navel, for in these cases the diverticulum is invaginated into the umbilical ring, and during the deligation of the cord its extremity is severed from the rest of the process. The intestinal coils which are found within the rupture of the inguinal region or an acquired umbilical hernia are, as is known, those possessing the longest mesentery. Elongation of the mesentery results from an actual increase in its length or from a ptosis of this structure. This was first pointed out by Richter to be an important factor in the causation of hernia. Anatomically, the longest mesentery is possessed by the lower ileum or by the same intestinal coils which are generally the site of Meckel's diverticulum when present. The fact that the lower ileum possesses the longest mesentery can be referred to embryological development, that is, to the umbilical flexure in which the omphalomesenteric duct is found at the height of the convexity in the intestinal loop, which portion is already at this time attached to the longest mesentery. At this point, moreover, the mesentery may still be further elongated by retention of the intestine within the cord beyond the normal period, so that when recession does occur the mesentery is of abnormal length. In the further development of the gastro-intestinal tract this increased length may be retained, and there is then established one of the primary predisposing factors for the causation of a hernia, which, when occurring, has among its contents Meckel's diverticulum, if this should exist.

Usually, the diverticulum is found within the hernial sac in conjunction with the intestinal coils to which it is attached. More rarely the diverticulum is found alone within the hernia. There is then what may be termed a true hernia of Meckel's diverticulum.

Such a case is reported by Dowse in a female, aged seventy-seven years, in which an artificial anus had formed in the right groin. At a postmortem three months after the formation of the fistula, a direct inguinal hernia was found whose sac contained a diverticulum which arose from the lower part of the ileum. Its distal extremity was adherent to the anterior side of the sac to the extent of half an inch. The diverticulum itself was funnel-shaped; its widest end, about two-thirds of an inch in diameter, being at the ileum, and was connected with the bowel almost exactly opposite to the mesenteric attachment. It measured one and one-half inches in length, was pervious throughout, and its coats were similar to those composing the walls of the ileum. Its mucous membrane was well marked and corrugated, having several oblique folds or valvuli conniventes of a small size. The orifice of the sac lay to the inner side of the obliterated hypogastric artery, so that a direct inguinal hernia existed. The fæcal fistula which had resulted had probably been produced by the fæcal accumulation and distention of the diverticulum, which was followed by ulceration and perforation. Although in this case no mention is made of Meckel's diverticulum, it seems most probable, from the description given, that this was the structure involved. Of congenital umbilical hernia which contains Meckel's diverticulum, the following cases have been reported:

Schroder gives the case of Muller, who, in a dead-born fœtus eight months old, found an umbilical hernia which contained a blind Meckel's diverticulum one inch long, and which was adherent to the neck of the sac.

Ahlfeld reports the case of a girl who died immediately after birth, which was slightly premature. She had an umbilical hernia which contained a diverticulum one to two inches long, whose extremity was adherent to the umbilical ring. A persistent omphalomesenteric artery running along the side of this diverticulum was also found. This artery lost itself in the mesentery of the small intestine near their junction.

Braus, in a child seven years old, found a protrusion at the umbilicus which measured eight centimetres, had a pedicle, and was but incompletely reducible. Upon opening the tumor, a Meckel's diverticulum was found, which was excised. Gluck, in a child born at seven months with an umbilical hernia and which had signs of peritonitis and strangulation, found that these symptoms had been caused by an accessory mesenteric fold bound to a diverticulum of Meckel's and passing over the intestine. A radical operation for umbilical hernia was performed, and both the diverticulum and mesenteric fold were resected.

Dunchamp reports a case of umbilical hernia in which operation was decided on, as the hernial sac was found thin and transparent, but quite reducible. Just as the operation was about to begin, the sac suddenly burst and the intestine flowed out en masse. Among the intestinal coils, the cæcum, appendix, sigmoid flexure, and a Meckel's diverticulum, two centimetres long and adherent to the herial sac by its extremities, were found.

Rosenblaum describes a case in which a persistent omphalomesenteric duct was found during the course of an operation for the radical cure of umbilical hernia.

Hallet gives the instance of a girl two hours old who had an irreducible hernia at the umbilicus the size of a fist. At the operation, the contents of its sac consisted of the cæcum with its appendix, and the small intestine with an adherent Meckel's diverticulum. A radical operation was performed, and the appendix and the diverticulum were removed.

Tiedeman, as quoted by Roth, found in a full-term male with a double cleft palate and harelip, and an accessory finger on both hands, an umbilical hernia the size of a walnut. Its contents were an intestinal loop, pyriform cyst fourteen and one-half lines in length, seven lines in width, and which had a pedicle or canal three and one-half lines long attached to the convex margin of the gut. The cyst contained a yellowish fluid and communicated through the canal with the lumen of the gut. Tiedeman thought this cyst to be the true umbilical vesicle. By Roth it is regarded as an enterocyst within a hernial sac.

Carle reports a case where, in an umbilical tumor, a hernia of Meckel's diverticulum was diagnosed. The operation confirmed the diagnosis. When the sac was opened, a small tumor, the size and form of a strawberry partly reducible, appeared. Its summit was pierced by an orifice, which led into a canal nine centimetres long, and from which a clear fluid with a fæcal odor oozed out in abundance. At birth the child, according to the mother, was attached to a short cord about the thickness of a man's thumb.

In inguinal hernia, the diverticulum, though more rarely found, has been noted in the following instances:

According to Morgagni, Benevoli has described a hernia which was constituted of an appendix to the ileum and extended into the scrotum, although it communicated with the intestine by an orifice, which, in the dead body, was not larger than a middling sized filbert, yet during fifteen days the patient vomited everything he took into his stomach, and at an early period of the disease threw up matter which resembled excrement. The ileum, to the extent of half an ell, at the part corresponding with the hernia, was not of its natural color, and was exceedingly corrugated and contracted.

Morgagni then describes a case which came under his observation: an inguinal hernia containing an incarcerated diverticulum. A porter, fifty years of age and broken down with constant labor, had a hernial tumor in the right groin the size of a man's thumb. Sometimes it apparently vanished, but about the middle of March, 1706, without any obvious cause, he was seized with pain in the abdomen. The pain though wandering was so severe that he compared it with canine gnawing. On the sixth day he was brought into the Hospital of St. Mary de Morte. His skin was nearly cold; his pulse exceedingly frequent and small; nor did it offer but slight resistance to the fingers, but it struck them with unequal force. The whole abdomen was distended like a drum, especially below the right hypochondrium, where the coils of the colon could be distinguished by the hand. The hernia was exceedingly tense, but was not the principal seat of his pain. He vomited his food and voided no fæces, nor could he even expel flatus. He died on the evening of the ninth day.

Dissection. The omentum was found extending into the hernia, and, with the exception of some broad transverse lines, it was generally reddened by inflammation. The spleen exhibited a morbid lividness, which penetrated a considerable depth into its substance. The stomach and the tract of small intestines, as far as the hernia, were greatly distended with a yellowish matter resembling fluid excrement. The large intestines were contracted and white, and it was evident that nothing had passed through the part of the ileum connected with the hernia, although merely a process of the intestine crossing the orifice entered the sac. This process was constituted of a projecting portion of the parietes, and was in the form of a semi-oval cavity, the larger axis of which, where it commenced gradually from the intestine, was about three digits in the longitudinal direction of the intestine; but the smaller axis was much less. From this commencement it progressively contracted and extended to the length of an inch. This portion, therefore, whether denominated a cavity or a diverticulum, was the only part of the intestine contained in the sac with the extremity of the omentum. Neither of these parts, however, could be withdrawn, not only from constriction in the orifice, but also in consequence of a fibrous adhesion to the sac. The sac itself was formed by the peritoneum, which protruded at the other side of the spermatic vessels, and on each side there existed an enlarged inguinal gland. That portion of the intestine which was contiguous to the sac, but more especially the diverticulum, was of a red color, inclining to lividness; and from this part to the stomach the coats of the canal were reddened by their turgid and crowded vessels, and the mesentery presented a similar appearance.

According to Thompson, Littre describes a case in which a Meckel's diverticulum four inches in length was found in a scrotal hernia of a man forty-eight years of age. Thompson reports the case of a colored man fifty years of age, with a left inguinal hernia, which had been at no time reducible and had been present for about ten years. On the day previous to that on which he was seen, it had occasioned him some trouble, and he had reduced it himself after attempting to do so for three hours, the rupture then entirely disappearing. During the night serious symptoms appeared, and in the morning the abdomen was somewhat tender and swollen on the left side. Vomiting at intervals of about half an hour; pulse, 120; temperature, 101° F. On opening the hernial sac, free fœtid gas, intestinal contents, and semipurulent fluid were discharged. The sac was entirely emptied and the internal ring free. Upon prolonging the incision upward towards the anterior superior spine, fæcal matter and pus were also evacuated from the abdominal cavity in great quantities. An unsuccessful search was then made for a perforation among the intestinal coils, which were matted together. Death shortly after. At the autopsy, which had been allowed only through the operation wound, a perforation was found at the base of a Meckel's diverticulum, which sprang from the ileum thirty-nine inches from the ileocæcal valve. The rent was two centimetres long, opening completely into the alimentary canal. At the apex and along one side were evidences of old peritonitic adhesions, which had probably bound it down firmly to the wall of the hernial sac.

Dugan gives the case of Vance, which was that of a delicate male child who had a reducible inguinal hernia, which became irreducible and strangulated. The usual operation for this condition was performed, strangulation having existed for six hours. The contents of the sac proved to be two coils of intestines ileum projecting through the ring with a Meckel's diverticulum wedged in between them, thus making reduction or taxis impossible. The diverticulum measured at least seven centimetres in length. Its lumen was as large as that of the gut. The usual steps for a radical cure were gone through with, the result being satisfactory. Banks, before the Liverpool Medical Institution, February 8, 1896, showed a Meckel's diverticulum which he had removed from the sac of a hernia, the small bowel being also present. It is not stated whether this was an umbilical or inguinal hernia.

Webster reports the following case. In a woman aged forty-two, who had fallen a few days before, a distended abdomen and a large tender mass in the left inguinal region, occupying the inguinal canal, was found.

Partial reduction was possible; but a hard mass looking like intestine was discovered, and on carefully opening the intestinal ring and separating the adhesions this was found to be a Meckel's diverticulum proceeding from close to the mesenteric border of the ileum, having a well-defined mesentery of its own. The mesentery was tied off and the diverticulum removed close to the ileum, and the opening of the bowel, which was of sufficient caliber to admit the tip of a finger, closed by a double row of Lembert sutures. The diverticulum measured three and one-half inches in length. The intestinal lumen was continuous for about three inches, the diverticulum ending in a mass showing some old inflammatory thickening. There was a good deal of inflammatory thickening of the ileum surrounding the diverticulum, showing that that portion had been constricted in the inguinal ring. The operation was completed by suturing the rings for a radical cure of the hernia. The patient made an uninterrupted recovery.

To these cases I wish to add the report of a case of strangulated hernia in which the contents of the sac consisted only of a rather large Meckel's diverticulum and a portion of the wall of the small intestine to which it was attached.

The patient was a male laborer, aged twenty-three years, who was admitted to Cleveland City Hospital, January 28, 1902, suffering from evident pain in his right groin and frequent vomiting. Twenty hours previous to his admission to the hospital, while lifting a heavy box, he was seized with a severe pain in the right inguinal region accompanied by a sudden tumor formation. This had never appeared before according to the patient's statement, but, as he was not a very intelligent man, reliance could not be placed on his statement. Vomiting soon set in, and persisted at frequent intervals, until upon admission to the hospital it was distinctly fæcal in character. Examination showed the patient to be suffering from shock, the abdomen was much distended, and the hernial tumor occupied the upper part of the scrotum and extended back along the inguinal canal. Under general anæsthesia, the hernial sac, which was very tense, was opened up and found to be filled with a dark, bloody fluid and what appeared to be a single knuckle of the intestine, resembling more a moderate sized gall-bladder. The peculiarity of its shape led to the pulling out of more intestine from the hernial orifice, and it was found to be a diverticulum six centimetres long by four centimetres in width. It was sharply constricted

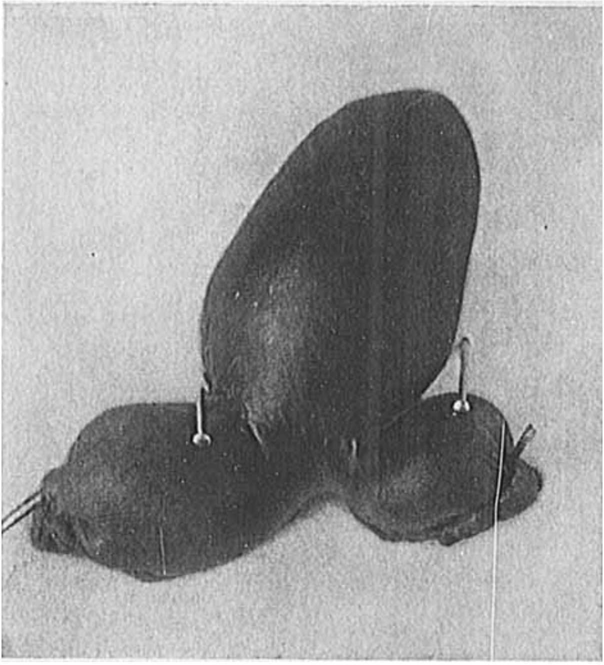

FIG. 1.—Meckel's diverticulum.

at its neck where a portion of the ileum had been pulled down into the sac and seized by the constricting ring. The diverticulum and adjacent portion of the ileum, as shown in the photograph (Fig. 1), were black and apparently at the point of gangrene. Exposure and hot applications did not affect the color; being afraid to return it, I decided to resect the intestine, removing about ten centimetres of the intestine on either side of the diverticulum and uniting the resected ends by a Murphy button. The gut was then returned to the abdominal cavity and the operation completed by the Bassini method. The wound healed without suppuration and no special symptoms developed. The patient left the hospital, March 31, 1902, able to resume work. The button had not yet passed.

BIBLIOGRAPHY.

Ahlfeld. Archiv. for Gynæcology, 1875, viii, 363; also Vol. xi.
Albers.
Allen. The Journal of Anatomy and Physiology, 1882, xvii, 59.
Banks. Lancet.
Barth. Deutsche Ztschr. Chir., 1887, p. 193.
Braus. Samml. klin. Vor., 1893, No. 77.
Buzzi. Virch. Archiv.
Carle. Lyon Méd., 1900, 236.
Cazin. Arch. Gen., 6 Sec., 1863.
Clarkson and Collard.
Coues. Medical and Surgical Reporter, Philadelphia, 1866, xv, 142.
Dennis. System of Surgery.
Dowse. Transactions of Pathological Society, London, 1874, 5, xxvi, 107.
Duchamp. La Loire Méd., Nov. 15, 1887.
Dugan. Pædiatrics, 1896, Vol. ii, p. 73.
Fitz. American Journal of the Medical Sciences, lxxxviii, 30.
Gluck. Berl. klin. Wchschr., January 19, 1885.
Hallet. Rev. de Gynecol., June, 1900.
Heisler. Text-Book of Embryology, 1899.
Hemmeter. Diagnosis of the Intestines, 1901.
Lamb. American Journal of the Medical Sciences, Vol. cv, 1893.
Leichtenstern. Ziemsen's Encyclopædia of General Medicine, Vol. vii, 1876.
Lockwood. British Medical Journal, 1897, ii, 459.
Kammerer. ANNALS OF SURGERY, 1897.
Kern. Beitr. z. klin. Chir., Vol. xix, 1897.
Meckel. Handbuch d. Path. Anat., 1812.
Mitchell. Journal of Anatomy and Physiology, xxxii, 675.
Morian. Arch. f. klin. Chir., Band lviii, 507.
Neuman. Festschr. r. Virchow, Berlin, 1901.
Rokitansky. Pathological Anatomy, Vol. ii, 1850.
Rosenblaum. Altona, 1898, 8.

Roser. Arch. f. klin. Chir., 1876, xx, 475.
Roth. Virch. Arch., lxxxvi, 377.
Schroeder. Ueber die Divertikel-Bildung am Darm-Kanale.
Shepard. Archives of Pædiatrics, Vol. ix, 1892.
Thompson. ANNALS OF SURGERY, 1898.
Tiedeman. Diekopflosen Missgeburten.
Tillman. Text-Book of Surgery. Deutsche Ztschr. f. Chir., xviii, 162.
Treves. Intestinal Obstruction, 1901.
Vance. Pædiatrics, 1898, 1172
Vaughn. New York Medical Journal, 1896.
Webster. ANNALS OF SURGERY, April, 1902.